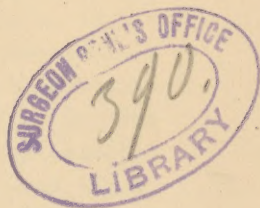


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OBSERVATIONS ON THE ULTIMATE DEFORM-
ITIES OF POTT'S DISEASE: THEIR
MODIFICATION AND PREVENTION,
WITH SPECIAL REFERENCE
TO THE MIDDLE REGION
OF THE SPINE.

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THE neglected cases at our clinics and the results of similar affections in animals show that, although unaided, Nature may overcome disease and finally adapt herself to adverse conditions, she is helpless to directly prevent deformity. This weakness affords the opportunity for the orthopedic surgeon, and although the diseases he treats are often directly or by their complications dangerous to life, his ability and success are estimated not by the survival of the patient, but by the degree of final deformity. The immediate treatment of disease must thus be modified by a foreknowledge of its effects, by the environment of the patient, and the intelligence of those who have charge of him. The balancing of the various factors that affect the life and future usefulness of the patient, the necessity of care and watchfulness through many years, and of moral and physical training to attain the best result, make this specialty one of the most difficult as well as one of the broadest and most humane of all the divisions of medicine.

The most important study, then, for the orthopedic surgeon is that of ultimate results—that we may learn of the direct danger to life from disease, and its complications, and thus come to a clearer understanding of its proper treatment; to apprehend on the one hand the significance of symptoms that demand operative interference, and to avoid, on the other, the needless sacrifice of joints by operations which disregard the final well-being of the patient.

By this study we learn that ultimate deformity, often attained after many years, is remarkably constant in its appearance, varying with the severity and duration of the disease and the function of the joint involved, but dependent on natural laws in its development, the voluntary and involuntary effort to relieve pain, the effect of irritation, tension, or pressure on the growth of bone, the force of gravity, and the final compensation for the change in attitude of the affected part.

If we accept the proposition that unchecked deformity may imply unchecked disease, that Nature not only cannot prevent direct deformity, but by its compensations in the growing child may induce secondary distortions, sometimes as exaggerated and important as the original, it follows that we should at all times endeavor to combat deformity, primary or secondary, which observation has shown to be the ultimate effect of the disease we are treating. Pott's disease differs somewhat from similar affections of other joints, in that early diagnosis is essential for absolute prevention of deformity, as the characteristic deformity resulting from destruction of bone cannot be directly remedied. On the other hand, the number of component joints of the spine that may take on the functions of those destroyed, and the position of the part covered by clothing, render this, when properly treated, a favorable region for an ultimately good result from an æsthetic point of view.

The ultimate deformities of Pott's disease vary with the region involved. When the two extremities of the elastic column are affected, the opportunity, so to speak, for deformity is small; it is opposed by the physiologic curves of the spine, and is easily compensated for. In the cervical region favorable factors in treatment are the small size and compact tissue of the vertebræ; the pain and early deformity caused by muscular spasm, which calls attention to the affection; the ease with which the head may be supported in proper position, and the amenability of the patient to bed-treatment, which so quickly relieves the symptoms; in the lower dorsal and in the lumbar region, the accuracy with which the spine may be supported and the attitude of the patient, the body being thrown backward, so that the weight falls behind the weakened point.

In disease of the middle dorsal region all these favorable factors

are wanting. The affection is often subacute in character, and is not recognized in the early stage. The deformity is favored by the normal posterior curvature of the spine and by the attitude of the patient. The disease is aggravated by the movement of the ribs in respiration, and by the movements of the arms suspended opposite the weakened point; and, finally, the compensatory changes in the spine and thorax exaggerate the deformity not only in the presence of active disease, but throughout the growing period.

To illustrate: In middle dorsal disease the attitude is often a drooping, sagging one; the inclination of the body is forward; the kyphosis lies between the shoulder-blades; above this point the spine bends sharply forward until the region of the head is reached; below the projection is a marked lordosis; the upper part of the chest is sunken and flattened, so that the shoulders appear elevated; the sternum is prominent, and the ribs compressed from side to side, changing the shape of the thoracic cavity from an elliptical to a cylindrical form. These characteristic changes, well marked in disease of long standing, are indicated even in cases of slight deformity. The kyphosis exaggerates the lordosis and the lordosis exaggerates the kyphosis. The weakened spine causes deformity of the chest, and the deformity of the chest, with the resulting displacement of the thoracic and abdominal viscera, not only increases the tendency to further deformity, but reacts on the general condition of the patient.

The first impression of the ultimate effect of the deformity of middle dorsal disease is misleading, as the attitude of the patient appears to be one of abnormal erectness, of elevation and squareness of the shoulders. This elevation is apparent only, and due to the sinking of the head and shortening of the neck. As the deformity increases the scapulæ are separated from one another, and the shoulders are relatively and actually displaced forward, so that a straight line may be passed between the heads of the humeri without touching the chest. Ultimate compensation for deformity relates to the proper position of the head. Normally the weight-line of the body passes through the mastoid process, the centre of the hip-joint, to the medio-tarsal joint of the foot.

Practically, this position is finally attained in disease of any region of the spine, and is attained by compensation for deformity

in the line of least resistance, which, in the region under consideration, is below the seat of disease. While the lower spine assumes the position of extreme lordosis, the upper part practically continues the angle of the kyphosis. In other words, there is no true compensation in the sense of antagonizing deformity in the upper segment. Thus, in untreated cases the trunk may become almost triangular in appearance, the head sunken into the base between the shoulders, midway from the projecting sternum in front and the kyphosis behind. We may assume, I think, that if the inferior lordosis or compensation in the region of least resistance were impossible, Nature, in the attempt to bring the head into the normal line, would under favorable circumstances produce a straightening and elevation of the superior portion, as it does in disease of the lower region, when compensation below is impossible.

The local deformity of Pott's disease is of slight importance compared with the effect on the spine as a whole. If, for example, the destruction of the body of a vertebra is represented by a V-shaped posterior projection, the actual deformity is measured by the length of its arms or its influence on the unaffected vertebræ. This influence does not depend entirely on the extent or severity of the disease, but rather on the situation, and, although we cannot separate the cause and effect in treatment, the prevention of unnecessary deformity in the region under consideration overshadows the importance of the disease, as the ultimate weakness and disability of the patient depends upon the deformity, the degree of which is limited, not by Nature, as in the upper and lower segments of the spine, but by the art of the surgeon. The importance of freeing the spine from the influence of local deformity is emphasized by the fact that active disease is usually accompanied by abscess and inflammation of the surrounding soft parts, so that contraction, with final consolidation in the deformed position, may be considered one of the factors in unnecessary deformity. Our efforts should be directed to straightening the entire spine above and below, and thus to limit the kyphosis to the actual extent of disease.

We may now consider how this object may be attained. It may be attained, I believe, by directing our attention to effects as well as to causes. If compensation takes place in the region of least resistance by an exaggeration of the lordosis, this lordosis must be

prevented. If the shoulders are displaced forward, overhanging the sunken chest, they must be drawn back to their full limit. If the chest becomes prominent and compressed laterally, this tendency must be restrained. If the head is thrust forward and downward, it must be supported, the chin elevated, and the weight thrown backward.

As I wish to call attention particularly to backward traction on the shoulders and restraint of unnecessary motion of the arms, I may explain why I believe this to be an important element in the treatment of disease of the middle region of the spine. In the normal spine, backward traction on the shoulders obliterates the physiologic posterior curvature in the dorsal region, while direct forward motion of the arms increases it. Backward traction makes

FIG. 1.

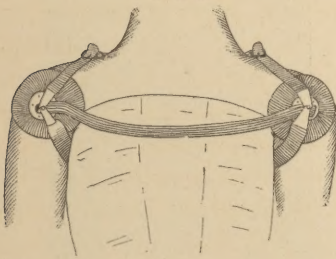
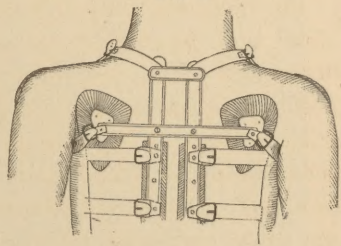


FIG. 2.



the chest appear more prominent, but actually diminishes its antero-posterior diameter. Forward movements of the arms act in the opposite way. Thus, backward action and restraint directly oppose the attitude and approximation to the deformity that is characteristic of the disease under consideration. In addition, it limits voluntary flexion of the spine to the cervical region, while, with the arms free, motion is possible to a much lower point. Backward traction through the clavicles and pectoral muscles tends to raise the upper portion of the chest, and through the serrati muscles to counteract the lateral compression. It assures an increased leverage at the seat of deformity, fixes the spine, and tends to limit the movements of the ribs.

If, in addition, the chin is elevated and supported, we may very effectually oppose the gradual sinking of the upper spine by assuring an habitual attitude of military erectness. The apparatus that

I have used has already been described in the *Transactions* of the last meeting. Muscular spasm having been overcome by rest, with extension if necessary, a Taylor back-brace is fitted, the bars being perfectly straight in the lumbar region, assuming that the deformity is moderate in degree. At the fifth dorsal vertebra a cross-bar is placed, terminating in two triangular rubber pads which cover the scapulæ. The brace is then applied, with the aim of drawing the lumbar spine firmly against the back bars. On the front, two

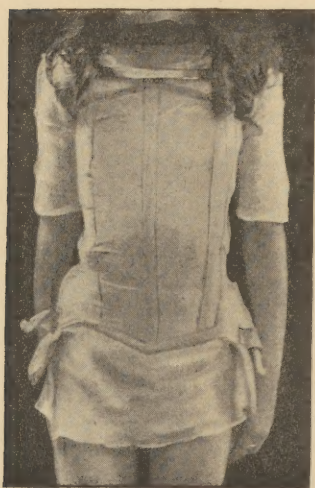
FIG. 3.¹

FIG. 4.

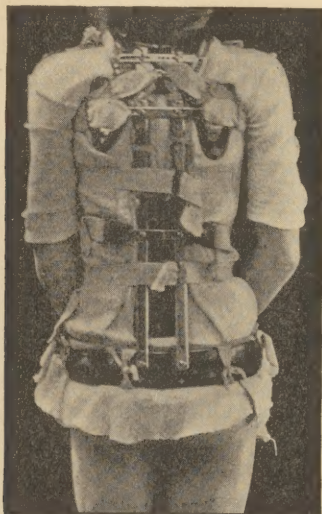


saucer-shaped rubber plates cover the prominence of the shoulders, resting on the deltoid muscles, and the heads of the humeri are connected by an unyielding steel bar that passes across the front of the chest. The shoulders are then drawn back to their full limit and the shoulder-plates firmly attached to the neck bars of the brace and the scapular pads behind. While the necessary motion of the arms is not to any extent restricted, the direct forward-reaching movements which tend to increase deformity are entirely prevented.

¹ The photographs illustrate the application of the brace with the chin support and the attitude attained in a case of well-marked deformity of the middle dorsal region. The patient was presented at the meeting of the Association.

The straightening of the spine and backward traction on the shoulders bring into relief the forward inclination of the neck and head. On this account I have used a light elliptical steel bar, passing from the brace behind, beneath the chin, with the object of supporting it, and tilting the head backward, to bring the weight of the occipital region into a more favorable position. If this attitude of military erectness can be maintained, the kyphosis is limited to the seat of actual disease, the spine is straightened above and below,

FIG. 5.



and is freed from the deforming influence of the angular projection. In the growing child we may hope by thus changing the pressure to modify the shape of the unaffected vertebrae so as to conform with the changed conditions, and prevent the gradual increase of general deformity that, in disease of this region of the spine, almost always takes place after apparent cure.

I am on this account very much inclined to doubt the statistics of cure of disease in a certain number of months or years, at least, in the sense of attainment of the best possible result. On the contrary, I believe that in many instances supervision is necessary throughout the entire period of growth, or until observation has

shown that the kyphosis in no way influences the unaffected spine, as shown by the habitual attitude of the patient.

The treatment here outlined may be considered proper in disease of the region between the fifth and tenth dorsal vertebræ—in other words, when the centre of the kyphosis is at or below the middle of the scapulæ.

A consideration of ultimate deformity shows that such treatment would be manifestly improper in, for example, disease of the third dorsal, when the final result to be expected is an excavation between the shoulder-blades, a flattening of the chest and backward displacement of the shoulders, a deformity quite the opposite of that under consideration. Nor would it be indicated in the lower region, when the inclination of the body is backward, and the lordosis tends to limit the disease; but when the upper portion of the body droops forward and the indications of final deformity are as have been described, I believe that we can by this means directly influence the course of the disease and its results.

As you are aware, there is another type of disease of the middle dorsal region, more often observed in young children, accompanied by evident weakness, in which the head hangs backward or on one shoulder, and the body is supported by the arms; there is the characteristic grunting respiration, the pain and other symptoms that accompany the acute phases of the disease, indicating the necessity for complete relief of the superincumbent weight by rest on the back.

If, however, middle dorsal disease may act as the cause of deformity through many years of growth, it is evident that bed-treatment can be but a temporary measure, indicated here, as in disease of other joints, by the symptoms.

While absolute rest may not be considered advisable or cannot be enforced, there is a modified form that may be of much importance—that by lengthening the time passed in bed and by periods of rest on the back during the day. The benefits of open air and exercise may thus be assured without injury to the patient, for, as is well known, in weakness or vulnerability of any joint, it is not the temporary activity that is harmful, but long-continued and unrelieved strain.

When the disease is no longer active, massage of the back and

abdomen may be employed. The brace may be removed at night and gradually made lighter and more suggestive in character.

I hope that it has been made clear that these remarks apply only to a certain region of the spine, to a selected class of cases, and particularly to a type of disease uncomplicated by great deformity or by acute symptoms; no attempt has been made to consider details of treatment or the management of complications on which ultimate success depends. I shall again call your attention to the principles of treatment by which I believe ultimate and unnecessary deformity may be overcome and avoided: The recognition of the fact that middle dorsal disease, in the sense of producing deformity, may be a factor that operates throughout the growing period; that deformity, direct and compensatory, should be combated from first to last; that attention should be directed to the entire spine and head, in the endeavor to attain a military erectness of attitude that can only be permanently assured by freeing the spine from the influence of local deformity and by developmental changes in the unaffected vertebræ; that backward traction of the shoulders and restraint of unnecessary movements of the arms are important factors in success, and that chin-supports are indicated whenever the inclination of the spine above the seat of disease is forward rather than backward.

These observations are presented as a contribution to the study of the treatment of disease in a region that, if neglected, produces greatest deformity, and in which the least satisfactory results are attained in those who have had the benefit of early and persistent care.

